IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#17 4/26/2

In re Application of:
Patrick Notte et al.

Group Art Unit: 1754

Serial No.: 09/320,077

Examiner: Vanoy, T.

Filed: May 26, 1999

Atty. Dkt. No.: SOLU:113/LUD

For: PROCESS FOR NITROUS OXIDE PURIFICATION

APPLICANTS' AMENDED APPEAL BRIEF

Assistant Commissioner for Patents
Washington, D.C. 20231

This is an appeal from the Final Rejection of claims 1-30. A copy of the rejected claims is attached in the Appendix of Claims (Tab A).

REAL PARTY IN INTEREST

The real party in interest is the Assignee of the application, Solutia Inc., St. Louis, Missouri, a corporation of the State of Delaware.

RELATED APPEALS AND INTERFERENCES

There are no other pending appeals or interferences of applications related to the above referenced application.

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Signature Sandra C. Larsen

STATUS OF CLAIMS

As of the Final Rejection, claims 1-30 were pending in the application and the subject of rejection. Applicants canceled claim 2 in a response dated May 22, 2001, but this has not been noted by the Examiner in the Final Office Action. Therefore claims 1 and 3-30 are on appeal.

STATUS OF AMENDMENTS

Applicants have filed no amendments subsequent to the final rejection in this case.

SUMMARY OF THE INVENTION

The present invention relates to a method for purification of a nitrous oxide gas by feeding the nitrous oxide gas and reducing agent or precursor thereof into a de-oxidation reactor, and performing de-oxidation by reacting the reducing agent or precursor thereof with oxygen using a catalyst to form an inert, in order to deplete the oxygen in the nitrous oxide gas, while limiting the amount of nitrous oxide removed from the nitrous oxide gas. (See page 3, lines 15-19; page 5, line 20 - page 6, line 27.)

Additionally, the present invention concerns a method for purification of a nitrous oxide gas by feeding the nitrous oxide gas and ammonia or a precursor thereof into a reactor system, performing selective catalytic reduction by reacting the ammonia or precursor thereof with NOx in the nitrous oxide gas using a selective catalytic reduction catalyst, feeding hydrogen or a precursor thereof into the reactor system and performing de-oxidation by reacting the hydrogen or a precursor thereof with oxygen in the nitrous oxide gas using a de-oxidation catalyst. (See page 3, lines 20-26; page 4, line 14 - page 7, line 2.)

ISSUES

Whether it was proper to reject claims 1 and 3-30 as unpatentable under 35 U.S.C. § 103(a) over German Patent Document No. 83,974 (English abstract provided by the Examiner, issued August 20, 1971, hereinafter "DD-974") in view of Matsuda et al. (U.S. Patent No. 4,351,811, issued September 28, 1982, hereinafter "Matsuda").

GROUPING OF CLAIMS

Claims 1 and 3-30 will stand and fall together.

ARGUMENT

The Examiner rejected claims 1-30 as unpatentable under 35 U.S.C. § 103(a) over DD-974 in view of Matsuda.

The fundamental basis for an obviousness determination under 35 U.S.C. §103(a) was set forth by the Supreme Court in *Graham v. John Deere Co.*, 383 U.S. 1; 148 U.S.P.Q. (BNA) 459 (1966). In subsequent cases involving a determination of obviousness under 35 U.S.C. §103, the Federal Circuit has noted that the following basic tenets of patent law must be adhered to: 1) the claimed invention must be considered as a whole; 2) the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination; 3) the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and 4) reasonable expectation of success is the standard with which obviousness is determined. *Hodosh v. Block Drug Co., Inc.,* 786 F.2d 1136, 1143 n.5, 229 U.S.P.Q. 182, 187, n.5 (Fed. Cir. 1986). The Federal Circuit has further indicated that any inquiry under 35 U.S.C. §103 is highly fact specific by design and that there are no per se rules of patentability. *In re Ochiai*, 71 F.3d 1565, 1569; 37 U.S.P.Q. 1127, 1131 (Fed. Cir. 1995).

The claims of the present invention are directed towards a method for the purification of a nitrous oxide gas which contains molecular oxygen. Claim 1 comprises feeding nitrous oxide gas and a reducing agent consisting of hydrogen, carbon monoxide, ammonia and mixtures thereof into a de-oxidation reactor, and reacting the reducing agent with oxygen using a de-oxidation catalyst to deplete the oxygen while limiting the amount of nitrous oxide which is removed.

DD-974 is directed toward a method for producing nitrous oxide gas and the purification of nitrous oxide gas contaminated with higher nitrogen oxides and oxygen. *See* DD-974, English

abstract under "Use/Advantage." As noted by the Examiner on page 4 of the July 20, 2001 Office Action, DD-974 differs from the present invention in that the only reducing agent DD-974 discloses is NH_2OH. Applicants also use a different selective reduction catalyst so that the reaction between ammonia or ammonia precursors and nitrogen oxides in the nitrous oxide gas is promoted.

Matsuda describes a process for removing nitrogen monoxide and ammonia out of gases emitted from a variety of industrial plants and processes by contacting the gas with a catalyst comprising titanium oxide and another oxide such as vanadium oxide so that the nitrogen oxides and ammonia react together to form nitrogen and water.

The Examiner, in a new argument in the Final Office Action, contends that it would have been obvious to one of skill in the art to substitute ammonia, hydrogen, or carbon monoxide for the hydroxylamine of DD-974 because of the following equation in Matsuda: $NO + NH_3 + 1/4O_2 \rightarrow (3/2)H_20$. The Examiner references MPEP section 2144.06 "Substitution of Equivalents for the Same Purpose" source of the case law allowing the substitution. Applicants respectfully traverse. Hydroxylamine is used in DD-974 to react with various components to form additional nitrous oxide. In the present invention, the reducing agent is used to remove oxygen from the gas mixture without significantly reducing the amount of nitrous oxide present. As claim 28 indicates, the NOx reacts with ammonia and not the hydroxylamine disclosed in DD-974. What DD-974 and Matsuda fail to show is how to react oxygen and NOx while leaving nitrous oxide untouched. One of skill in the art would expect ammonia to react with nitrous oxide, and hydrogen to also react with nitrous oxide. In the case of hydrogen as the reducing gas, nitrogen and water would be the expected products. *See* page 6, ll. 18-21 of the present invention.

The Examiner's "obvious to try" argument is not proper in the present case for several reasons. First, obviousness does not exist if the prior art neither indicates which of the disclosed parameters are critical nor gives direction as to which of may choices is likely to be successful. *Merck & Co. Inc. v. Biocraft Labs., Inc.*, (CAFC 1989) 874 F2d 804, 10 PQ2d 1843. In a catalytic process, simple substitution of a feed component does not give one a "reasonable expectation of success." The effect of a modification of one prior art catalytic process in a manner employed in another prior art process which employs a different catalyst was held unpredictable. *Ex parte Berger et al.* (POBA 1952) 108 USPQ 236. The Examiner even acknowledges that the catalyst of

the present invention is a different, selective reduction catalyst, from the type of catalyst used in DD-974. *See* Page 4, last paragraph of the Final Office Action.

Additionally, Applicants respectfully submit that it was improper for the Examiner to allege that it was obvious to utilize the Matsuda catalyst in conjunction with the DD-974 process because the Matsuda catalyst activity for the reaction between NO and NH_3 is "very excellent." Matsuda teaches nothing about how its catalyst reacts with nitrous oxide. There is also no suggestion to use the Matsuda catalyst in a process which purifies nitrous oxide or even contains nitrous oxide. The mere fact that the prior art may be modified does not make the modification obvious unless there is a suggestion of the desirability to do so. *See In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783-84 (Fed. Cir. 1992).

Further, there is no suggestion in Matsuda to use a reducing agent other than ammonia. Applicants claim ammonia, hydrogen, carbon monoxide and mixtures thereof as reducing gases in the purification of nitrous oxide. Also, Matsuda does not suggest the unexpected finding of the present invention that hydrogen, when used as the reducing gas, does not deplete the nitrous oxide in the offgas by forming nitrogen and water. The unexpectedness of the product produced by the claimed process is relevant in determining whether the claimed subject matter as a whole is obvious. Thus, a process which produces an unobvious product, the production of which would not be apparent from the reactants employed, is patentable even though the use of such reactants would be obvious to one skilled in the art and the product would inherently result therefrom. *In re Naylor* (CCPA 1966) 369 F2d 765, 152 USPQ 106.

Also, the substitution of the reducing agent in the DD-974 would not allow it to function properly. If hydrogen replaced the hydroxylamine in the third reaction of DD-974, one would certainly not be able to manufacture nitrous oxide using this reaction. The Federal Circuit has noted that if the proposed modification would render the prior art invention being modified unsatisfactorily for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

In view of the foregoing arguments, it is respectfully requested that the Board reverse the outstanding rejection of claims 1-30 and remand the case to the Examiner for further prosecution and allowance.

Respectfully submitted,

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APPENDIX A

Claims on Appeal

1. (Amended) A method for purification of a nitrous oxide gas containing O_2, said method comprising:

feeding said nitrous oxide gas and a reducing agent selected from the group consisting of hydrogen, carbon monoxide, ammonia and mixtures thereof into a de-oxidation reactor;

performing de-oxidation by reacting said reducing agent with O_2 using a de-oxidation catalyst to form an inert, in order to deplete said O_2 in said nitrous oxide gas, while limiting the amount of nitrous oxide removed from said nitrous oxide gas.

2. Canceled.

3. (Amended) A method according to Claim 1, wherein said reducing agent is hydrogen.

4. (Amended) A method according to Claim 1, wherein said inert comprises water or carbon dioxide.

5. A method according to Claim 1, wherein said inert is water.

6. (Amended) A method according to Claim 1, wherein said nitrous oxide gas further comprises NOx, nitrogen, carbon monoxide, carbon dioxide or organic compounds.

7. A method according to Claim 6, wherein said NOx is removed from said nitrous oxide gas by selective catalytic reduction using ammonia or a precursor thereof and a selective catalytic reduction catalyst.

8. A method according to Claim 6, wherein said carbon monoxide and organic compounds are removed from said nitrous oxide gas during said de-oxidation.

9. A method according to Claim 1, wherein said nitrous oxide gas comprises adipic acid off-gas.

10. (Amended) A method according to Claim 9, wherein said off-gas comprises between 1000 ppmv and 10 vol.% O_2, and between 100 ppmv and 1% NOx.

11. (Amended) A method according to Claim 1, wherein up to 99 vol.% of said O_2 is removed from said nitrous oxide gas.

12. (Amended) A method according to Claim 1, wherein said de-oxidation catalyst is selected from the group consisting of palladium, platinum and mixtures thereof.

13. (Amended) A method according to Claim 7, wherein said selective catalytic reduction catalyst is selected from the group consisting of oxides of vanadium, titanium and mixtures thereof.

14. A method according to Claim 1, wherein said de-oxidation step is performed with more than one reactor.

15. A method according to Claim 7, wherein said selective catalytic reduction is performed in a selective catalytic reduction reactor separate from said de-oxidation reactor.

16. A method according to Claim 15, wherein said selective catalytic reduction reactor is a lateral flow reactor.

17. A method according to Claim 7, wherein steam is used as a carrier gas for said nitrous oxide gas during said selective catalytic reduction.

18. (Amended) A method according to Claim 7, wherein prior to said selective catalytic reduction, an oxygen containing gas is passed over said selective catalytic reduction catalyst.

19. (Amended) A method for purification of a nitrous oxide gas comprising;

feeding an O_2 and NOx containing nitrous oxide gas and ammonia or a precursor thereof into a reactor system;

performing selective catalytic reduction by reacting said ammonia or precursor thereof with NOx in said nitrous oxide gas using a selective catalytic reduction catalyst;

feeding a reducing agent into said reactor system;

performing de-oxidation by reacting said reducing agent with O_2 in said nitrous oxide gas using a de-oxidation catalyst.

20. (Amended) A method according to Claim 19, wherein said nitrous oxide gas further comprises NOx, nitrogen, carbon monoxide, carbon dioxide or organic compounds.

21. A method according to Claim 19, wherein said reactor system comprises more than one reactor.

22. (Amended) A method according to Claim 19, wherein said de-oxidation catalyst is selected from the group consisting of palladium, platinum and mixtures thereof.

23. (Amended) A method according to Claim 19, wherein said selective catalytic reduction catalyst is selected from the group consisting of oxides of vanadium, titanium, and mixtures thereof.

24. A method according to Claim 19, wherein said selective catalytic reduction reactor is a lateral flow reactor.

25. A method according to Claim 19, wherein steam is used as a carrier gas for said nitrous oxide gas during said selective catalytic reduction.

26. (Amended) A method according to Claim 19, wherein prior to said selective catalytic reduction, an oxygen containing gas is passed over said selective catalytic reduction catalyst.

27. (Amended) A method according to Claim 19, wherein recovery of nitrous oxide from said nitrous oxide gas utilizing said reactor system is greater than 95%.

28. (Amended) A method for purification of a nitrous oxide gas comprising;

feeding an NOx containing nitrous oxide gas and ammonia or a precursor thereof into a reactor system;

performing selective catalytic reduction by reacting said ammonia or precursor thereof with NOx in said nitrous oxide gas using a selective catalytic reduction catalyst; while limiting the amount of nitrous oxide removed from said nitrous oxide gas.

29. (Amended) A method according to Claim 28, wherein said nitrous oxide gas further comprises nitrogen, carbon monoxide, carbon dioxide or organic compounds.

30. A method according to Claim 28, wherein said organic compounds are selectively removed from said nitrous oxide gas stream by said selective catalytic reduction.